123888

April 17, 2009 943-6222

WORK PLAN FOR
ADDITIONAL GROUNDWATER DELINEATION

216 Paterson Plank Road Site
Operable Unit No. 3 (OU-3)

INTRODUCTION

At the request of the USEPA, additional groundwater delineation will be performed at the 216 Paterson Plank Road Site in advance of Bench- and Field-Scale Treatability Studies being conducted as part of the Feasibility Study for Operable Unit No. 3 (OU-3). The proposed locations for the additional groundwater delineation are shown in the attached Figures 1 and 2 and the scope of work is summarized below. All field work will be conducted in accordance with the existing Site Health and Safety Plan developed for Operable Unit No. 2 (OU-2).

BACKGROUND AND OBJECTIVES

The 216 Paterson Plank Road Site has two distinct areas of impacted deep groundwater that constitute OU-3. Each of the areas has a different chemical "signature": The northern corner of the Site (proximal to MW-5D) and downgradient areas are impacted with predominantly chlorinated ethenes; and the southern corner of the Site (proximal to MW-21D) is impacted predominantly with 1,4-dioxane and to a lesser extent 1,1-dichloroethane and benzene.

The objective of the proposed delineation work is to address the following data gaps:

Northern Corner
Groundwater samples will be collected from a boring in the till in the area between existing monitoring wells RMW-11D and RMW-12D, to aid in the assessment of the till groundwater quality and to assess the adequacy of the current monitoring well network in this area. Based upon the results of this initial sampling, additional borings/wells may be included in a future phase of work.

A till boring will also be made proximal to MW-23R to assess a possible location for the Enhanced Anaerobic Bioremediation (EAB) Pilot-Scale Test. This information will provide baseline chemistry data to assess whether the location is appropriate for the pilot test. The proposed locations for both borings in the northern area are shown on Figure 1.

Southern Corner
Additional delineation in the southern corner of the site is necessary to determine the vertical and lateral extent of the elevated 1,4-dioxane observed in existing wells MW-21D and MW-22D. This delineation will be used to evaluate alternatives in the Feasibility Study, and to determine the optimal location for the *In Situ* Chemical Oxidation (ISCO) Pilot-Scale Test. The horizontal extent of 1,4-dioxane within the till will be assessed with three (3) borings. The vertical extent of 1,4-dioxane will be assessed with the installation of a soil boring/bedrock monitoring well in the vicinity of existing well MW-21D.

Groundwater samples will also be taken for delineation of 1,4-dioxane from existing till monitoring well MW-18D (screened deeper than MW-17D) and bedrock monitoring well MW-8R, collocated with MW-17D, which were not previously sampled for this compound.

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Drilling Procedures

The approximate locations of the borings are shown on Figures 1 and 2. Please note that these boring locations are approximate and are contingent on negotiated access agreements and field conditions. All utilities will be appropriately marked-out prior to mobilization to the Site.

Golder proposes to subcontract Boart Longyear Company, Environmental & Infrastructure Drilling Services (Boart Longyear) of Windsor, New Jersey to advance the borings using rotosonic methods. Sonic drilling is a dual cased system that employs high frequency vibration to obtain continuous core samples of unconsolidated formations and many consolidated formations (including bedrock), and to advance casing for well construction and other purposes. Sonic rigs have been used successfully in till formations and present a high degree of confidence for use on-Site (see Attachment 1 for additional information).

Delineation borings in the till in the northern and southern areas will be installed using a four (4)-inch core barrel with a six (6)-inch sonic casing drilled to the top of bedrock. Groundwater samples from the borings will be collected at specific intervals in the till using a two (2)-inch diameter screen set with a neoprene packer on the top to seal the screen to the casing. The casing will be backed-off to open the two (2) foot long screen section and the well will be purged and sampled using a Grundfos RediFlow pump. During purging, field parameters will be monitored in a flow-through cell until parameters have stabilized and indicate that formation water is passing through the cell, at which point the flow-through cell will be disconnected and a groundwater sample collected. Samples will be collected at approximately 10 foot intervals in the till. The borings will be grouted in accordance with New Jersey procedures for well decommissioning.

Bedrock well installation in the vicinity of existing well MW-21D (see Attachment 1) will utilize a seven (7)-inch core barrel and eight (8)-inch override casing bored through the overburden and set into the varved clay layer. A six (6)-inch core barrel and a seven (7)-inch override casing will then be advanced through the till and set into the bedrock. Groundwater samples will be collected for the till during this phase, as described above. A four (4)-inch core barrel and a six (6)-inch override casing will be bored 20 feet into the bedrock unit. A two (2)-inch stainless steel screen and casing will be set as the permanent bedrock well. The annular space above the sandpack between the two (2)-inch stainless steel and six (6)-inch override casing will be pressure grouted. Development of the well will be accomplished by surging and pumping with a small submersible pump or air lift system.

During the investigation, plastic-sleeved rotosonic cores will be collected continuously at each boring location and samples from each interval of interest (i.e., Soft-till, Lodgement-till and bedrock) will be collected for bench-scale testing. Each sample will be logged and visual observations will be recorded on the soil boring logs (discoloration, staining, layering, odors, etc.). The plastic sleeve of the core sample will be cut at discrete intervals to allow scanning with a photo-ionization detector (PID). At the end of each day, the supervising field geologist/engineer will determine the appropriate samples to submit to the laboratory for bench-scale ISCO testing.

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Groundwater will be sampled from the existing monitoring wells in accordance with the sampling technique described in the revised QAPP for the Off-Property Groundwater Investigation for OU-3.

Decontamination Procedures
Drilling equipment will be pressure washed prior to the initial borehole, between boreholes, and after the last borehole is completed. All such activities will be performed at a designated decontamination pad.

The decontamination pad will be constructed on-Site and will meet the following minimum specifications:

- The pad will be constructed on a sloped surface that facilitates the flow of rinse water to a low corner or sump for collection.
- Rinse water will be removed from the decontamination pad as needed. Rinse water pumped from the decontamination pad will be containerized and disposed in the onsite groundwater holding tank.
- The pad will be lined with a water impermeable material. This material should be either easily replaced (disposable) or repairable.

All sampling equipment will be decontaminated in accordance with NJDEP's Field Sampling Procedures Manual (NJDEP, 2005) between sample locations. Additionally, all investigation derived waste (IDW) will be containerized in 55-gallon steel drums and staged on-Site. Liquid IDW (i.e., decontamination water) will be added to the on-Site groundwater collection system for treatment and disposal.

Groundwater Sampling
All groundwater samples will be analyzed for VOCs and 1,4-dioxane. The groundwater sample collected from the Soft Till during construction of the bedrock well (as part of sampling for the ISCO bench tests) will also be analyzed for metals, and select conventional parameters (TOC, sulfate, sulfide, chloride, nitrate, nitrite, dissolved iron, and alkalinity).

Soil samples will be collected during installation of the bedrock well for ISCO bench tests. Samples will be collected from the interval corresponding to the screen interval of MW-21D (-21 to -28 MSL). Soil samples from the MW-21D area will be analyzed for VOCs, and 1,4-dioxane, metals, and select conventional parameters (TOC, Fe+2, carbonate, bicarbonate, alkalinity). Samples collected for VOC and 1,4-dioxane analysis will be collected in dedicated or decontaminated small-diameter core samplers (Purge and Trap Soil Sampler®, EnCore® sampler, Easy Draw Syringe® or other equivalent small-diameter tube/plunger sampler). Soil samples for non-VOC analysis will be thoroughly homogenized using decontaminated stainless steel bowls and spoons prior to placement into laboratory provided sample-ware (i.e., glass jars), packaged with ice, and submitted under Chain-of-Custody (COC) procedures to the laboratory.

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CompuChem of Cary, North Carolina will perform the chemical analyses using the following United States Environmental Protection Agency (USEPA) method guidelines:

- VOCs following USEPA CLP Statement of Work (SoW) SOM01.1 (5/2005) Analytical Method for the Analysis of Low/Medium Concentrations of Volatile Organic Compounds, including Modifications Updating SOM01.1 to SOM01.2 (October, 2006);
- 1,4-Dioxane following USEPA CLP SoW SOM01.1 (5/2005) Analytical Method for the Analysis of Trace Concentrations of Volatile Organic Compounds along with SOM01.1 Modifications Updating SOM01.1 to SOM01.2 (October, 2006);
- Metals following USEPA CLP SoW ILM05.3 (3/2004) Statement of Work for Inorganic Analysis, including ILM05.3 to ILM05.4 Summary of Changes (December 2006);
- TOC following Standard Method[1] 5310B Total Organic Carbon by High-Temperature Combustion;
- Sulfate, Nitrite, Nitrate, Chloride by USEPA MCAWW[2] 300.0 Determination of Inorganic Anions by Ion Chromatography;
- Sulfide following Standard Method 4500-S2F;
- Ferrous Iron following Standard Method 3500-Fe;
- pH following Standard Method 4500H-B Electrometric Method;
- Carbonate following Standard Method 2320B Titration Method;
- Bicarbonate following Standard Method 2320B Titration Method; and
- Alkalinity following USEPA MCAWW Method 310.2.

Quality Assurance / Quality Control (QA/QC) samples, including one (1) matrix spike/matrix spike duplicate (MS/MSD), one (1) field duplicate, and one (1) rinsate blank, will be submitted. A trip blank will also be submitted for VOC analysis for each day samples are sent to the laboratory.

SAMPLE HANDLING, CUSTODY AND SHIPMENT

Sample Handling

The laboratory will supply appropriately prepared sample containers. Preservation procedures and analytical holding times will be in accordance with the published analytical methods and USEPA Region II guidelines as further detailed below.

Sample Preservation

Sample containers will be kept closed until the time they are to be filled. After filling, the containers will be securely closed, residue wiped from the sides of the containers, and immediately placed in a cooler containing ice. Samples shall be cooled to approximately 4°C immediately after collection. This temperature should be maintained for samples during storage and shipment to the laboratory and a temperature blank will be placed in each cooler returned to

[1] Standard Methods for the Examination of Water and Wastewater
[2] USEPA, 1983, Methods for Chemical Analysis of Water and Wastes, EPA600/4-79-20, Office of Research and Development, Washington, D.C.

the laboratory. Samples requiring chemical preservatives will be collected into pre-preserved containers obtained from the laboratory.

Sample Identification
All samples shall be marked for identification from the time of collection and packaging through shipping and storage. Marking shall be on a sample label attached to the sample container. Sample identification shall include, as a minimum:

- Project name and/or code;
- Sample identification number;
- Analysis requested;
- Chemical preservatives;
- Sample date and time (military time); and,
- Initials of the individual performing the sampling.

Each sample will be assigned a unique sample identification (ID) to be recorded on the sample label. Each sample ID will be recorded in the field notebook, a Sample Field Information Form and on chain-of-custody (COC) documentation.

Sample Custody
Chain of Custody (COC) procedures have been established to ensure sample traceability from the time of collection through completion of analysis. All samples will be handled under strict COC procedures beginning in the field. The following procedure will be used to maintain COC of samples.

Samples and sample containers must be kept under proper COC during field sampling. If custody of the samples (and sample bottles) is exchanged during field sampling, such transfer must be documented on the COC form. The departing field staff should sign indicating the custody has been relinquished, and the arriving field staff should sign indicating responsibility for the custody of the samples. The COC form and Field notebook (and/or field information form) should include the sample identification information described above and any special comments related to the sample.

When shipping samples to the laboratory, all sample bottles and requested analyses will be noted on the COC form. Where multiple analytical methods are available for a particular analysis, the specific method number should be listed on the COC form.

One member of the sampling team will sign the COC form relinquishing custody to the laboratory. If using an overnight courier service, record the tracking number on the COC. The COC form will be sealed inside the shipping container with the samples. The paperwork should be sealed inside a plastic bag to prevent damage from water condensation. The courier does not need to sign the COC form if it is sealed within the shipping container using custody seals. If the

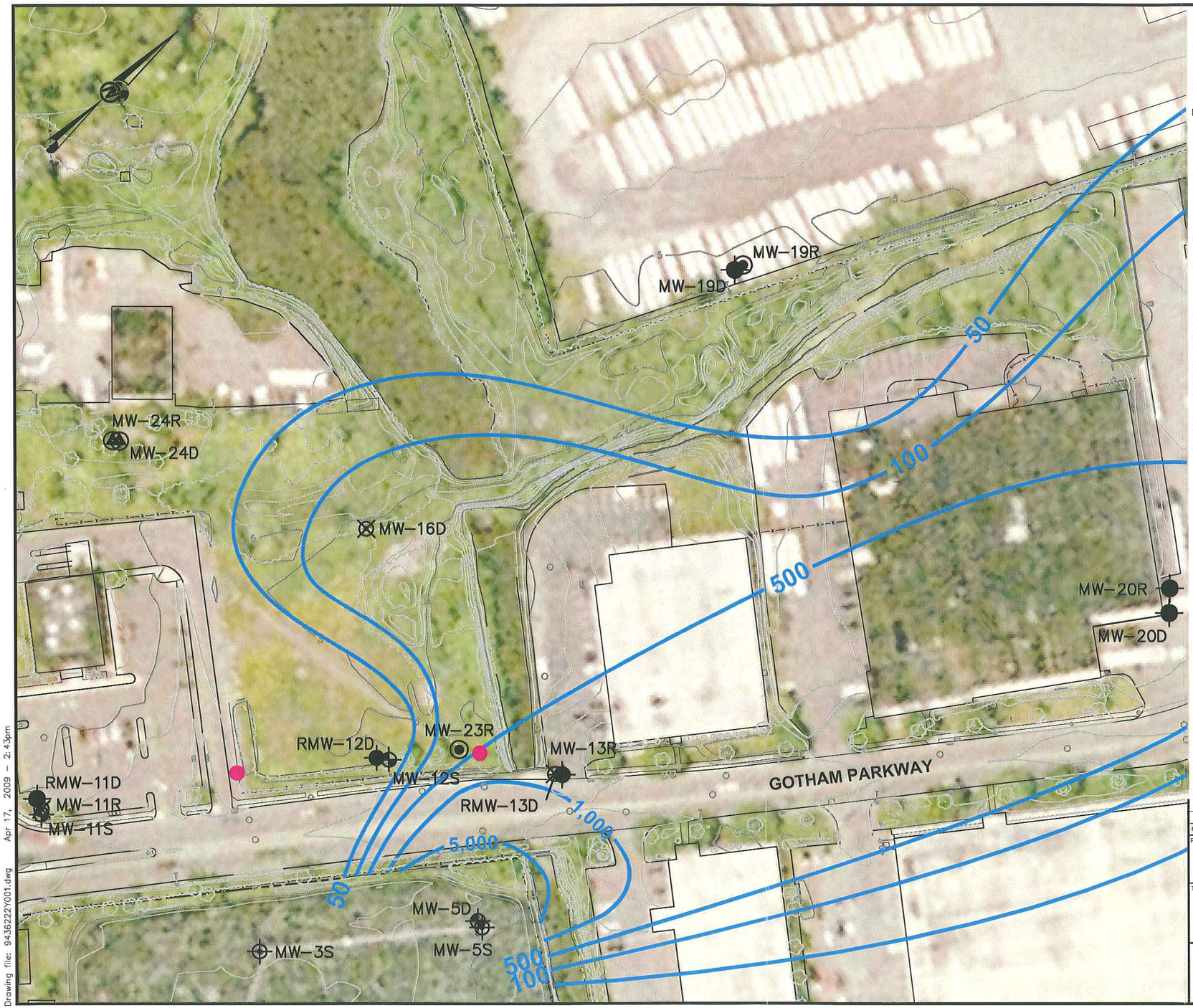
samples are hand delivered to the laboratory by field staff, the COC form will be signed at the laboratory when the samples are delivered, and the shipping container does not need to be sealed as long as it is kept under proper COC until delivered to the laboratory. If possible, COC seals should be signed and dated, and the serial numbers listed on the COC form.

DATA VALIDATION

All laboratory data for samples collected during this sampling event will be validated according to USEPA Region II guidelines and method-specific criteria.

REPORTING

Results from this additional delineation, being conducted in advance of the approval of the Work Plan for the Bench- and Field-Scale Treatability Study, will be provided to USEPA following data validation and utilized to refine the scope of subsequent field and laboratory studies in consultation with USEPA. Formal reporting of the data will occur in conjunction with the Treatability and Feasibility Studies.



LEGEND

- MW-8D — MONITORING WELL (INSTALLED DURING THE REMEDIAL INVESTIGATION)
- MW-8D — ABANDONED WELL
- MW-18D — MONITORING WELL (INSTALLED DURING THE OFF-PROPERTY INVESTIGATION -JULY 1996)
- MW-18D — MONITORING WELL (INSTALLED DURING THE OFF-PROPERTY INVESTIGATION - AUGUST 1998)
- MW-15R — MONITORING WELL (INSTALLED DURING THE OFF-PROPERTY INVESTIGATION - NOVEMBER 2002)
- PROPOSED LOCATION OF DELINEATION BORING
- PROPERTY BOUNDARY
- 2007 TOTAL VOC ISOCONCENTRATION CONTOUR (ug/L) (TILL)

REFERENCES

1.) BASE MAP SHOWN TAKEN FROM DIGITAL FILE 3074-02-TOPO.DWG, ENTITLED "BOROUGH OF CARLSTADT BLOCK 124 LOTS 1 THROUGH 5," DATED DECEMBER 8, 2005, PREPARED BY PROMAPS.

2.) HORIZONTAL DATUM REFERENCES THE NEW JERSEY STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD 83). VERTICAL DATUM REFERENCES THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

3.) MONITORING WELLS (1996 AND RI WELLS), PIEZOMETERS, AND EXTRACTION WELLS SURVEYED BY GEOD CORPORATION (OCTOBER 1996). WELLS INSTALLED IN 1998 SURVEYED BY GEOD CORPORATION. WELLS INSTALLED IN 2002 AND 2007 SURVEYED BY JAMES M. STEWART, INC.

80 0 80
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
216 PATERSON PLANK ROAD NPL SITE
CARLSTADT, NEW JERSEY

TITLE
NORTHERN AREA PROPOSED DELINEATION BORING LOCATION

NJ Authorization #24GA28029100
Golder Associates
Philadelphia USA

PROJECT No.	943-6222		FILE No.	94362222Y001
DESIGN	MJB	04/02/09	SCALE AS SHOWN	REV. 0
CADD	RG	04/17/09		
CHECK				
REVIEW				

FIGURE 1

Drawing file: 94362222Y001.dwg Apr 17, 2009 - 2:43pm

LEGEND

MW-8D	EXISTING MONITORING WELL
MW-NEW1	PROPOSED BEDROCK WELL
B09-1	PROPOSED DELINEATION BORING
2800	1,4 DIOXANE CONCENTRATION (ug/L) JUNE, 2007
(1300)	1,4 DIOXANE CONCENTRATION (ug/L) OCTOBER, 2007
NM	NOT MEASURED
	SITE PROPERTY-BOUNDARY
	CONTOUR LINE
	STREAM
	FENCE
	UTILITY POLE
	APPROXIMATE SLURRY WALL ALIGNMENT

NOTE

1.) COORDINATE SYSTEM SHOWN IS NEW JERSEY STATE PLANE NAD27 AND VERTICAL DATUM BASED ON NAVD 1929.

REFERENCES

1.) TOPOGRAPHIC DATA AND SURFACE FEATURES BASED ON INFORMATION BY TAYLOR, WISEMAN & TAYLOR CONSULTING ENGINEERS / SURVEYORS / PLANNERS / LANDSCAPE ARCHITECTS, MOUNT LAUREL, NEW JERSEY, DATED JUNE 12, 1992.

2.) 2005 AERIAL PHOTO BASE PROVIDED BY GLOBEXPLORER.™

30 0 30 60
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
216 PATERSON PLANK ROAD NPL SITE
CARLSTADT, NEW JERSEY

TITLE
1,4 DIOXANE DELINEATION BORINGS

Golder Associates
Philadelphia USA

PROJECT No.	943-6222		FILE No.	94362227002	
DESIGN	HAL	04/03/09	SCALE	AS SHOWN	REV. 0
CADD	RG	04/17/09	FIGURE 2		
CHECK	MJB	04/17/09			
REVIEW	PSF	04/17/09			

ATTACHMENT 1

BOART LONGYEAR

Boart Longyear Company
Environmental & Infrastructure
Drilling Services

PO Box 485
Windsor, NJ 08561
TEL (609) 490-1550 / Fax (609) 490-1565

www.boartlongyear.com

April 3, 2009

Heather Lin
Golder Associates Inc.
200 Century Parkway
Suite C
Mt. Laurel, NJ 08054

Re: Paterson Plank Rd.

Dear Heather,

We offer the following process for drilling the bedrock monitor well at the site in the corner of the ABF parking lot:

- Move SONIC drill with crew to the boring site. We understand that utilities will be marked and located by others and that hand clearing will be necessary. Setup & prepare to drill with our drill through tub and 9-inch surface casing.
- Using a 7-inch core barrel and 8-inch override casing, we will core and case through the shallow formation to locate the varved clay at about 14 feet. We will seat the casing into the clay and extend the pipe into the derrick.
- We will fill the casing with water and conduct a 15 minute falling head test to prove the efficacy of the seal between the 8-inch casing shoe and the clay.
- We will continue to drill using a 6-inch core barrel and 7-inch override casing. We will core and case through the till formation to locate the bedrock surface at about 54 feet. We will seat the casing into the rock and once again extend the pipe into the derrick.
- We will again fill the casing with water and conduct a 15 minute falling head test to prove the efficacy of the seal between the 7-inch casing shoe

and the bedrock.

- We will continue to drill into the rock using a 4-inch core barrel and 6-inch SONIC override casing to your target depth.
- A 2-inch, 304 stainless steel screen & casing will be installed and centered in the 6-inch SONIC casing and the annular space will be filled in lifts as the 6-inch SONIC casing is pulled from the ground.
- The remaining annular space will be filled with grout, filling it from bottom to the top by pumping through a tremie pipe.
- The 7, 8 & 9-inch casing will be pulled from the ground in reverse order. The SONIC drill head will be engaged to pull the casing and this will serve to degas the grout, and knit the grout into the borehole wall making a superior seal between the formation and the casing.

We call this process a Multiple Aquifer Penetration. We attach a graphic for your reference. We have used this SONIC drilling technique at numerous locations in New Jersey with case by case approval of the NJDEP.

Again, we appreciate the opportunity to be of service to Golder Associates Inc., and look forward to working together. If there are any questions, or if we can be of any assistance, please feel free to contact me.

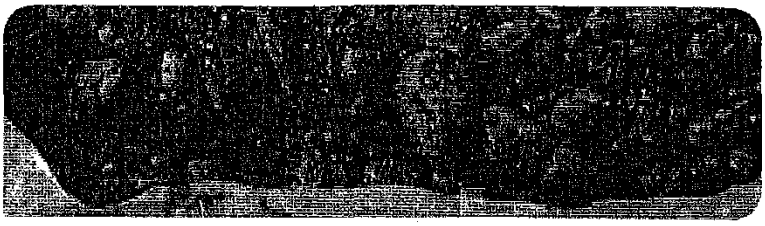
Sincerely,
Boart Longyear E&I Drilling Services

William B. Armstrong
Director of Business Development-MidAtlantic Region

warmstrong@boartlongyear.com

Encl.

www.boartlongyear.com



SAVE TIME, MONEY AND ELIMINATE THE POTENTIAL FOR CROSS CONTAMINATION

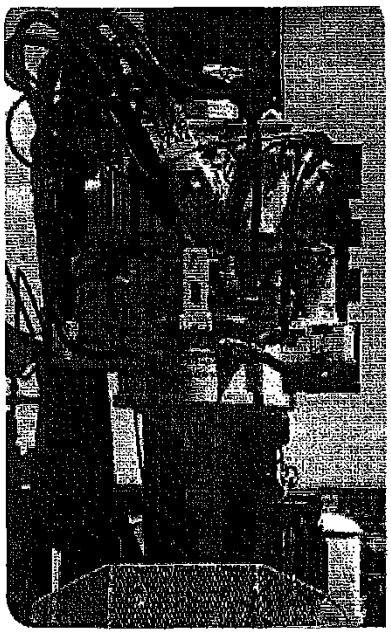
Sonic Multi-Case Advancement System

Penetrate and access multiple aquifers <u>without</u> permanent surface casing

Conventional borehole drilling in contaminated areas runs the risk of facilitating the migration of contaminants from one zone into another. In many documented cases, drilling activities have caused the spread of contamination into zones that were previously considered uncontaminated, either through drilling or through improperly grouted surface well casings.

Consequently, it is standard industry procedure to first grout in a permanent surface casing before penetrating a confining layer or aquitard. This process is time consuming, expensive and doesn't always ensure against creating a pathway for contaminants to travel.

BOART LONGYEAR
Drilling Services

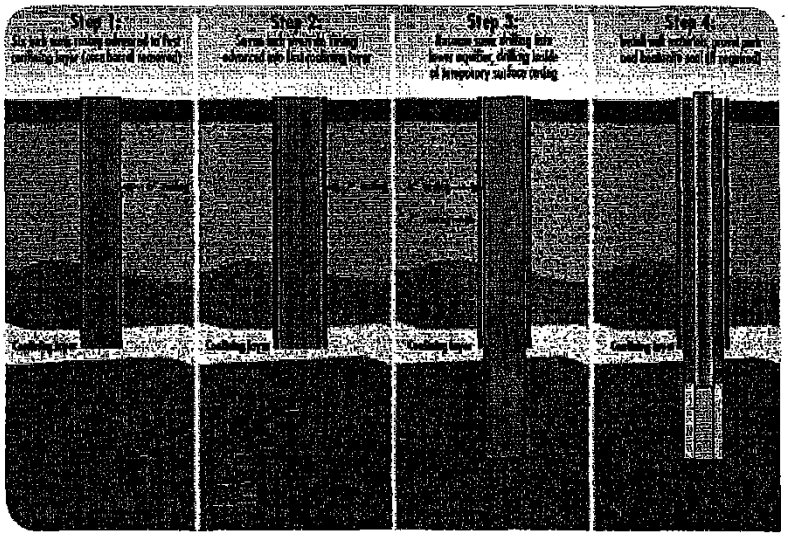


Fortunately, Boart Longyear's sonic drilling method with its casing advancement system offers a more effective way - saving time, money and eliminating the potential for cross contamination.

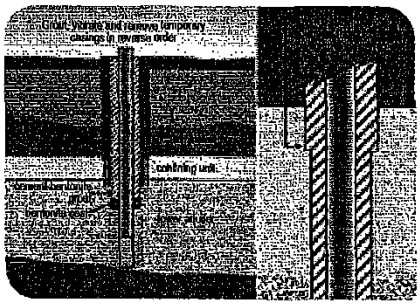
Boart Longyear's casing advancement system can eliminate permanent surface casings. Alternatively, temporary sonic casings are used to seal isolated zones, which are then removed upon completion of the borehole and final grouting.

The sonic casing advancement system utilizes larger diameter casings that are over-drilled into a confining layer. A smaller diameter drill string is placed inside the temporary surface casing and advanced to depth.

THE PROCESS



To complete the process the borehole is then grouted which seals off the lower aquifer(s) from the aquifers cased with the 7 inch (17.8cm).



Once the borehole has been grouted the next step is for the 6 inch (15.2 cm) casing to be withdrawn from the boring with sonic energy being applied and then the 7 inch (17.8 cm) casing string is also withdrawn from the boring again using resonant energy to assist its smooth retraction. As a result , installation has been completed in a fraction of the time compared to conventional drilling and fewer materials are used (no permanent surface casing required).

CASING ADVANCEMENT PROCESS

STEP 1. CORE AND CASE A 6 IN (15.2 CM) BOREHOLE INTO THE CONFINING LAYER.

STEP 2. SONICALLY OVERRIDE A 7 IN (17.8 CM) CASING INTO THE CONFINING LAYER OVER THE 6 IN (15.2 CM) CASING. CASINGS CAN THEN BE PRESSURIZED WITH WATER OR AIR, IF REQUIRED.

STEP 3. RESUME SONICALLY CORING AND CASING A 6 IN (15.2 CM) BOREHOLE TO DEPTH INSIDE OF THE 7 IN (17.8 CM) CASING. NO SONIC ENERGY IS APPLIED TO THE 7 IN (17.8 CM) CASING.

STEP 4. INSTALL WELL MATERIALS (SCREEN, RISER PIPE, GRAVEL PACK, SEAL, AND GROUT).

STEP 5. AFTER WELL INSTALLATION AND GROUTING, REMOVE THE SONIC CASINGS IN REVERSE ORDER.

For more information on other projects and services, please contact your Boart Longyear Drilling Services representative today.
Email: info@boartlongyear.com

ISO 14001

BOART LONGYEAR
Drilling Services

R2-0000690